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COMPARISON OF BACKCROSSED LINES OF
BISON FLAX THAT POSSESS DIFFERENT
RUST CONDITIONING ALLELES IN
UNIFORM NURSERY TRIALS
1959

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Compiled by

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INTRODUCTION

Lines of Bison that possess one or more important rust-conditioning alleles have been developed by backcrossing during the past decade by the Research Pathologist, ARS, located at Fargo, North Dakota. Other plant breeders seeking rust-conditioning alleles can utilize these lines much more effectively than they can the original varieties possessing the rust alleles because of the desirable agronomic type of Bison. Certain backcrossed lines of Bison may serve as rust-immune commercial varieties in the event that new virulent races of rust should become prevalent. Sixteen of the more advanced backcrossed lines were selected for testing in regional trials in 1959 together with Bison, Redwood, and Marine (Table 1). The tests were conducted to compare the agronomic performance of the backcrossed lines with Bison and two other check varieties.

Standard testing procedures were employed. Rod-row plots 3 rows wide replicated 3 times were grown at each location. Sixteen feet of the center row of each plot were harvested for seed yield determination. Bulk seed samples of the lines and varieties in three trials were analyzed for oil content and iodine value. Notes were also recorded on relative blooming date, maturity, plant height, and test weight.

The testing stations and cooperators were as follows:

Fargo, North Dakota	North Dakota State College	H. H. Flor
Brookings, South Dakota	South Dakota State College	Dale Harpstead
Morris, Minnesota	West Central Experiment Sta.	Roy Thompson
Crookston, Minnesota	Northwest Experiment Sta.	Olaf Soine
St. Paul, Minnesota	University Farm	V. Comstock

Table 1. Varieties and backcrossed lines of Bison that were grown in cooperative regional trials in 1959.

Variety ^{1/} or cross	C.I. or No. Dakota number	Rust allele(s) present in line
Bison	C.I. 389	-
Redwood	C.I. 1130	N ¹ P
Marine	C.I. 1135	L
B7 x 1182	58-I-1	M ³
B6 x 1085	58-I-11	L ⁶
B6 x 1336	58-I-12	L ¹⁰
B6 x 708	58-I-4	L ²
B5 x 1513	58-I-15	P ³
B6 x 1085	58-I-16	L ⁶
B4 x 1186	58-I-5	?
B6 x 1188	I-2	K
B6 x 42	58-I-6	N
B5 x 1335	58-I-14	N ²
B5 x 1191	58-I-17	N ¹
B4 x Kug. C	58-I-19	?
B7 x 1085)(B8 x 1182	58-I-22	L ⁶ M ³
B7 x 1085)(B7 x 1191	57-F15	L ⁶ N ¹
B7 x 1085)(B8 x 1182	58-I-32	L ⁶ M ³
B x 1118)(B5 x 1182	57-F166	M ³ N ¹

^{1/} Letter B followed by number indicates number of backcrosses made to Bison.

RESULTS

Maturity data were recorded from all five trials. These are shown in Tables 2 through 6 with means of all stations recorded in Table 8. Seed yield data were obtained from four of the trials. Pasmo infection, which occurred in irregular patches, and rather severe lodging made it impractical to harvest the trial at St. Paul (Table 6). Rust and wilt readings were made at Fargo (Table 2).

Seed Yields

The seed yields produced by the backcrossed lines and three check varieties were not significantly different at three of the four locations. At Brookings, South Dakota, the yields ranged from 11.7 bu. for 58-I-6 to 14.6 bu. for Bison. The L.S.D. was determined to be 0.3 bushels (Table 3).

The seed yields of four trials are summarized in Table 7. The mean yields of all stations were not significantly different when "variety x location" was used as error in the analysis of variance. The line 57-Fl66 was the only one that was consistently among the lowest yielding in all trials.

Table 2. Agronomic and disease data from backcrossed lines of Bison grown in regional trials in 1959.

FARGO, NORTH DAKOTA

Variety or cross	C.I. or N.D. No.	Maturity ^{1/}	Rust ^{2/}	Wilt ^{3/}	Seed per acre Bu.
Redwood	C.I. 1130	L	0	4	26.0
B6 x 1085	58-I-16	M	0	3	25.6
B4 x 1186	58-I-5	L	0	2	25.1
B5 x 1513	58-I-15	E	0	3	24.7
Marine	C.I. 1135	E	0	2	24.5
B6 x 708	58-I-4	M	0	4	24.5
B7 x 1085) (B8 x 1182	58-I-32	E	0	3	24.3
B7 x 1085) (B7 x 1191	57-F15	M	0	3	24.1
B4 x Kug. C	58-I-19	M	L	3	24.0
B5 x 1191	58-I-17	M	0	3	24.0
B7 x 1182	58-I-1	M	0	3	23.9
B6 x 1336	58-I-12	E	0	3	23.8
B7 x 1085) (B8 x 1182	58-I-22	M	0	3	23.7
B5 x 1335	58-I-14	E	0	3	23.5
Bison	C.I. 389	E	H	3	23.4
B6 x 1085	58-I-11	E	0	3	23.2
B6 x 42	58-I-6	M	0	3	23.1
B x 1118) (B5 x 1182	57-F-166	M	0	4	22.8
Average					24.1
L.S.D. (5%)					N.S.

^{1/} E=early; M=intermediate; and L=late maturity.

^{2/} O=none; L=light; and H=heavy rust infection.

^{3/} Vigor readings 1 to 9 with lower numbers indicating greater wilt resistance.

Table 3. Agronomic data from backcrossed lines of Bison grown in regional trials in 1959.

BROOKINGS, SOUTH DAKOTA

Sown: May 12

Variety or cross	G.I. or N.D.No.	Days from sowing to:		Test wt. per bu.	Seed per A. Bu.
		First bloom	Full bloom		
Bison	C.I. 389	44	49	55	14.6
Marine	C.I. 1135	45	49	55	14.1
B7 x 1085)(B8 x 1182	I-22	45	49	54	14.1
B7 x 1085)(B7 x 1191	57-F15	45	48	53	13.9
B7 x 1182	58-I-1	46	50	54	13.8
Redwood	C.I. 1130	47	51	54	13.7
B6 x 1085	58-I-16	45	49	54	13.7
B7 x 1085)(B8 x 1182	58-I-32	45	49	53	13.5
B4 x 1186	58-I-5	45	48	54	13.4
B4 x Kug. C	58-I-19	45	49	55	13.4
B6 x 1188	I-2	45	48	55	13.3
B5 x 1335	58-I-14	45	48	54	13.2
B5 x 1191	58-I-17	45	48	53	13.2
B6 x 1336	58-I-12	45	50	54	13.1
B6 x 1085	58-I-11	45	49	55	12.7
B5 x 1513	58-I-15	45	48	54	12.7
B6 x 708	58-I-4	45	49	53	12.6
B x 1118)(B5 x 1182	57-F166	49	52	53	12.3
B6 x 42	58-I-6	45	48	54	11.7
					<u>13.3</u>
					<u>0.3</u>

L.S.D. (5%)

Table 4. Agronomic data for flax varieties and backcrossed lines of Bison grown in regional trials in 1959.

MORRIS, MINNESOTA

Sown: April 23

Variety or cross	C.I. or N.D.No.	Days from sowing to:		Ht. In.	Test wt. lbs/bu	Seed per A. Bu.
		First bloom	Full bloom			
B6 x 1085	58-I-11	53	59	20	55.0	27.3
B7 x 1182	58-I-1	53	60	20	55.5	26.9
Redwood	C.I. 1130	51	57	19	54.5	26.4
B5 x 1513	58-I-15	52	59	20	54.0	25.7
B7 x 1085)(B8 x 1182	58-I-22	52	58	20	55.0	25.0
B6 x 1188	I-2	52	59	19	55.0	24.9
B4 x Kug. C	58-I-19	52	59	21	55.0	24.8
B5 x 1191	58-I-17	52	59	19	54.5	24.2
B6 x 1336	58-I-12	53	60	20	55.0	24.1
Bison	C.I. 389	53	59	21	54.0	23.7
B5 x 1335	58-I-14	53	60	19	54.0	23.5
B6 x 42	58-I-6	53	59	19	54.5	22.4
B7 x 1085)(B8 x 1182	58-I-32	52	58	18	55.0	21.8
B x 1118)(B5 x 1182	57-F166	52	60	19	54.0	21.7
B6 x 1085	58-I-16	53	60	19	55.0	21.1
B7 x 1085)(B7 x 1191	57-F15	54	60	19	54.0	20.9
B6 x 708	58-I-4	52	60	18	55.0	20.7
B4 x 1186	58-I-5	53	59	17	55.5	19.8
Marine	C.I. 1135	50	56	18	55.0	19.0
Average		52	59	19	54.7	23.4
L.S.D. (5%)						N.S.

Table 5. Agronomic data for flax varieties and backcrossed lines of Bison grown in regional trials in 1959.

CROOKSTON, MINNESOTA

Variety or cross	C.I. or N.D.No.	Days from sowing to:			Ht. In.	Test wt. lbs/bu	Seed $\frac{1}{2}$ per A. bu.
		First bloom	Full bloom	Ripe			
B4 x 1186	58-I-5	58	64	108	19	54.5	25.6
B6 x 1085	58-I-16	57	62	107	20	54.5	24.5
B6 x 1336	58-I-12	55	61	106	19	55.0	24.0
B6 x 1085	58-I-11	58	63	108	19	55.0	23.9
B5 x 1513	58-I-15	54	60	108	20	54.5	23.9
B6 x 1188	I-2	59	64	108	19	54.5	23.8
B6 x 708	58-I-4	59	63	107	20	53.0	23.4
B7 x 1085)(B7 x 1191	57-F15	53	58	111	19	55.0	23.4
Redwood	C.I. 1130	54	61	107	17	56.0	23.1
B4 x Kug. C	58-I-19	55	61	107	19	55.0	23.1
Marine	C.I. 1135	54	59	107	18	55.0	22.1
B5 x 1335	58-I-14	56	62	108	19	54.5	21.8
B7 x 1182	58-I-1	59	64	108	19	55.5	21.7
Bison	C.I. 389	58	63	107	19	53.0	21.6
B7 x 1085)(B8 x 1182	58-I-22	57	63	109	19	55.0	21.5
B6 x 42	58-I-6	56	61	109	19	54.5	21.4
B7 x 1085)(B8 x 1182	58-I-32	57	62	109	19	55.0	20.7
B x 1118)(B5 x 1182	57-F166	57	62	109	19	55.0	20.5
B5 x 1191	58-I-17	55	61	111	19	55.0	20.2
Average		56	62	108	19	54.7	22.6
L.S.D. (5%)							N.S.

Table 6. Agronomic data for flax varieties and backcrossed lines of Bison grown in regional trials in 1959.^{1/}

ST. PAUL, MINNESOTA

Sown: April 15		Days from sowing to:				Ht. In.
Variety or cross	C.I. or N.D.No.	First bloom	Full bloom	Last bloom		
Bison	C.I. 389	56	61	73	24	
Redwood	C.I. 1130	54	60	73	23	
Marine	C.I. 1135	54	58	70	23	
B7 x 1182	58-I-1	57	61	73	24	
B6 x 1085	58-I-11	56	61	73	24	
B6 x 1336	58-I-12	56	61	73	24	
B6 x 708	58-I-4	56	61	73	24	
B5 x 1513	58-I-15	55	61	73	24	
B6 x 1085	58-I-16	56	61	73	24	
B4 x 1186	58-I-5	56	61	73	24	
B6 x 1188	I-2	56	61	73	24	
B6 x 42	58-I-6	55	61	73	23	
B5 x 1335	58-I-14	56	61	73	24	
B5 x 1191	58-I-17	55	61	73	23	
B4 x Kug. C	58-I-19	56	61	73	24	
B7 x 1085)(B8 x 1182	58-I-22	56	61	73	24	
B7 x 1085)(B7 x 1191	57-F15	55	61	73	23	
B7 x 1085)(B8 x 1182	58-I-32	56	61	73	23	
B x 1118)(B5 x 1182	57-F166	56	61	73	24	
Average		56	61	73	24	

^{1/} Seed yields were not taken because of bad lodging and subsequentasmus infection.

Table 7. Summary of flaxseed yields from backcrossed lines of Bison grown in regional trials at four locations in North Central Region in 1959.

Variety or Cross	C.I. or N.D.No.	Seed per acre in bushels				Average of 4 locations
		Fargo No.Dak.	Brookings So. Dak.	Morris Minn.	Crookston Minn.	
Bison	C.I. 389	23.4	14.6	23.7	21.6	20.8
Redwood	C.I. 1130	26.0	13.7	26.4	23.1	22.3
Marine	C.I. 1135	24.5	14.1	19.0	22.1	19.9
B7 x 1182	58-I-1	23.9	13.8	26.9	21.7	21.6
B6 x 1085	58-I-11	23.2	12.7	27.3	23.9	21.8
B6 x 1336	58-I-12	23.8	13.1	24.1	24.0	21.2
B6 x 708	58-I-4	24.5	12.6	20.7	23.4	20.3
B5 x 1513	58-I-15	24.7	12.7	25.9	23.9	21.8
B6 x 1085	58-I-16	25.6	13.7	21.1	24.5	21.2
B4 x 1186	58-I-5	25.1	13.4	19.8	25.6	21.0
B6 x 1188	I-2	23.7	13.3	24.9	23.8	21.4
B6 x 42	58-I-6	23.1	11.7	22.4	21.4	19.6
B5 x 1335	58-I-14	23.5	13.2	23.5	21.8	20.5
B5 x 1191	58-I-17	24.0	13.2	24.2	20.2	20.4
B4 x Kug. C	58-I-19	24.0	13.4	24.8	23.1	21.3
B7 x 1085)(B8 x 1182	58-I-22	23.7	14.1	25.0	21.5	21.1
B7 x 1085)(B7 x 1191	57-F15	24.1	13.9	20.9	23.4	20.6
B7 x 1085)(B8 x 1182	58-I-32	24.3	13.5	21.8	20.7	20.1
B x 1118)(B5 x 1182	57-F166	22.8	12.3	21.7	20.5	19.3
Average		<u>24.1</u>	<u>13.3</u>	<u>23.4</u>	<u>22.6</u>	<u>20.9</u>
L.S.D. (5%)		N.S.	<u>0.3</u>	N.S.	N.S.	N.S.

Agronomic Data

A summary of agronomic notes recorded at the five stations are shown in Table 8. There were no lines that differed by more than a day from Bison in reaching first and full bloom. The maturity date of two lines, 57-F15 and 58-I-17, were 2 and 3 days later than that of Bison which is probably not an important difference.

There were no apparent differences between the plant height of any of the lines and Bison.

Table 8. Summary of agronomic data from backcrossed lines of Bison grown in regional trials at five locations in North Central Region. 1959.

Variety or cross	C.I. or N.D.No.	Days from sowing to:				Ht. In.	Test wt. per bu.	Seed per A.
		First bloom	Full bloom	Ripe				
		4	4	2				
No. of stations						3	3	4
						In.		
Bison	C.I. 389	53	58	111	21	54.0	20.8	
Redwood	C.I. 1130	52	57	111	20	54.8	22.3	
Marine	C.I. 1135	51	56	111	20	54.7	19.9	
B7 x 1182	58-I-1	54	59	112	21	55.0	21.6	
B6 x 1085	58-I-11	53	58	112	21	55.0	21.8	
B6 x 1336	58-I-12	52	58	111	21	54.7	21.2	
B6 x 708	58-I-4	53	58	110	21	53.7	20.3	
B5 x 1513	58-I-15	52	57	111	21	54.2	21.8	
B6 x 1085	58-I-16	53	58	111	21	54.5	21.2	
B4 x 1186	58-I-5	53	58	111	20	54.7	21.0	
B6 x 1188	I-2	53	58	112	21	55.0	-	
B6 x 42	58-I-6	52	57	112	20	54.3	19.6	
B5 x 1335	58-I-14	52	58	112	21	54.2	20.5	
B5 x 1191	58-I-17	52	57	114	20	54.2	20.4	
B4 x Aug. C	58-I-19	52	58	112	21	55.0	21.3	
B7 x 1085)(B8 x 1182	58-I-22	52	58	112	21	54.7	21.1	
B7 x 1085)(B7 x 1191	57-F15	52	57	113	20	54.0	20.6	
B7 x 1085)(B8 x 1182	58-I-32	52	58	111	20	54.3	20.2	
B x 1118)(B5 x 1182	57-F166	54	59	112	21	54.0	19.3	
Average		52	58	111	21	54.5	20.9	

Oil Content and Iodine Value

The oil percentages, as determined on seed samples from three trials, are shown in Table 9. The mean oil percentages ranged from 38.7 to 39.4 among backcrossed lines and Bison averaged 39.7 percent oil. Differences between means of varieties and lines were not significant when "variety x location" was used as error in the analysis of variance.

There were significant differences between the mean iodine value of Bison and ten of the backcrossed lines (Table 9). One line had a mean iodine value that was significantly lower than that of Bison.

Table 9. Oil content and iodine value of flaxseed from backcrossed lines of Bison grown in regional trials at three locations in North Central Region in 1959.

Variety or cross	C.I. or N.D.No.	Oil content (percent)			Iodine value		
		Fargo*	Morris	Crookston Av.	Fargo*	Morris	Crookston Av.
Bison	C.I. 389	39.3	39.6	40.1	172	166	172
Redwood	C.I. 1130	38.3	39.8	39.4	177	179	181
Marine	C.I. 1135	38.0	38.8	39.8	184	185	187
B7 x 1182	58-I-1	37.5	39.9	39.1	171	170	173
B6 x 1085	58-I-11	38.6	39.4	39.9	172	173	176
B6 x 1336	58-I-12	37.7	39.5	39.0	172	172	174
B6 x 708	58-I-4	38.3	40.3	39.1	172	171	167
B5 x 1513	58-I-15	37.8	40.5	40.0	169	168	167
B6 x 1085	58-I-16	38.3	39.8	40.2	174	174	175
B4 x 1186	58-I-5	38.1	40.1	40.1	165	166	169
B6 x 1188	I-2	-	38.7	39.2	-	172	175
B6 x 42	58-I-6	37.8	39.9	39.1	171	172	177
B5 x 1335	58-I-14	37.4	39.5	39.8	173	174	177
B5 x 1191	58-I-17	38.0	40.1	39.8	172	177	178
B4 x Kug. C	58-I-19	38.1	38.9	39.4	173	174	174
B7 x 1085)(B8 x 1182	58-I-22	37.6	39.3	39.9	175	175	176
B7 x 1085)(B7 x 1191	57-FL5	38.0	39.2	39.6	173	177	179
B7 x 1085)(B8 x 1182	58-I-32	38.0	39.2	39.0	173	171	173
B x 1118)(B5 x 1182	57-FL66	37.1	39.4	40.0	169	170	170
Average		38.0	39.6	39.6	173	173	175
L.S.D. (5%)				N.S.			2.9

* Seed quality data for Fargo supplied by Dr. Flor; remaining data obtained from seed analyses at St. Paul.

